MSDS 413, Summer 2019, Assignment 8
Multivariate Time Series Models (TS8)

Introduction

The file q-fdebt.txt contains the U.S. quarterly federal debts held by foreign and international investors, and federal reserve banks. The data are from the Federal Reserve Bank of St. Louis, from 1970 to 2012 for 171 observations, and not seasonally adjusted. The debts are in billions of dollars.

The following list defines the variables:

- year: year of the debts
- mon: starting month of the quarterly debts
- hbfin: debt held by foreign and international investors
- hbfrbn: debt held by federal reserve banks

The log return of the daily exchange rate between Japanese Yen and U.S. Dollar from July 6, 2005 to April 18, 2014. The log return data are in the file d-fxjpus0514.txt.

Your objective is to explore the time series behavior of these data sets including EDA, modeling, model diagnostics, and interpretation.

Procedure

The following steps are necessary to complete this assignment. Address each and every part and ensure that you cover all the details specified in the questions.

1. **Debt** (3 points) Use the file q-fdebt.txt which contains the U.S. quarterly federal debts held by foreign and international investors, and federal reserve banks.
    1.1. Use EDA to justify a log transformation and a first difference transformation, z_{it}, of each time series for $i = 1, 2$ hbfin and hbfrbn, respectively.
    1.2. Obtain the first 5 lags of sample cross-correlation matrices of the z_{it}.
    1.3. Test $H_0 : \rho_1 = \cdots = \rho_{10} = 0$ versus $H_a : \rho_j \neq 0$ for some j, where $j \in \{1, ..., 10\}$. Draw the conclusion using the 5% significance level.
2. **GDP** (3 points) Consider the growth rates, in percentages, of the quarterly real GDP of United Kingdom, Canada, and the United States located in the object **qgdp** in the **MTS** R package.
    2.1. Use EDA to justify a $VAR(4)$ model.
    2.2. Fit a $VAR(4)$ model to the series and perform model checking.

2.3. Simplify the model by removing insignificant parameters with type-I error rates at $\alpha = 0.05$.

2.4. From each model's diagnostics, compare the $VAR(4)$ and the simplified models. Suggest and justify which model, if either, is best.

3. **Report** (1.5 points) Write an executive summary of the outcomes of your GDP analysis.

Deliverables

See Section Submission Directions below. The assignment deliverables, each in pdf format, are as follows:

- *Only if requested by instructor*
  - The program or script
  - Logs
  - Outputs
- Mandatory
  Data analysis write-up: no programs, logs, or just code outputs.

The data analysis must follow and use the item numbering of each assignment, i.e., use the numbers, say, 1 - 5, with the sub-lettering if used. These deliverables are provided according to the instructions in the Submission Directions section below.

Submission Directions

Title Page

Include a title page with your name and the assignment designation. Leave room for instructor comments.

File Names

The assignment write-up file shall be submitted to Canvas according to the schedule in the syllabus using the item (1) naming convention below. The naming convention is case sensitive. Use letters and numbers as given. **The file name parts have no spaces or other separator charancters**.
TS8Lastname.pdf (submit via Canvas)

The parts are the assignment code, TS8; your lastname with only the first letter capitalized; a period, and lastly, the extension "pdf". Generically,

TS8Lastname.pdf

For example: Suppose your name is Student McStats. Your filename then is:

TS8Mcstats.pdf

The analysis write-up file must be submitted for grading. Each write-up requires a title page for instructor comments. The analysis may use either R or any other statistics package you wish, or if you use more than one package, you must use the germane tables, plots, etc., in a single report. If you use more than one package, differences and similarities should be indicated.

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Email *ONLY IF REQUESTED* the program (script), log and output as separate pdf files. The R log and output may be combined. The file names shall be as follows:

- The program or script file names
  - TS8LastnameRprog.pdf
- The log file names
  - TS8LastnameRlog.pdf